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Headlight Switch Control using Raspberry Pi

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***Abstract* - Accidents which have occurred in the past few years have increased at a massive rate and there has been no significant measures taken by the authorities to control the figures. Automobile industries have become very competitive on their customer base to grow day by day which makes them decrease the price of a vehicle by compromising on the safety features ultimately resulting to more accidents. Accidents in the night time are even more deadly which is mostly due to the oncoming vehicles headlight. Hence to overcome accidents a step is taken by proposing an effective system for detecting vehicles captured through the camera assistance. This system helps driver to automatically switch between the high beam and low beam on detection of a vehicles headlight which further avoids the glare.**

***Keywords:* Automobile industries, camera assistance, high beam, low beam, vehicles headlight..**

I. INTRODUCTION

Headlights are the most essential requirement during the night time in any possible scenario. Headlight which is an assistant to the driver for better vision during night travel is also a main cause for many accidents which may occur. Drivers are the main and sole in-charge of the vehicle; have to control the switching from high beam to low beam. System on the vehicles is adjusted according to the driver for the best possible comfort for them to drive. During dark conditions when no other sources of light are present, high beam is used else low beam is preferred. In a two-way traffic, vehicles plying are on both sides of the road. When on high beam, the bright light from the headlamps of the vehicle passing on the opposite direction have to face serious discomfort. This results in the disorientation for the drivers. This discomfort finally makes involuntary closing of the driver's eyes at times. The fraction of distraction is the root cause of many road accidents that occur. The prototype that is has been designed, actually reduces this issue by dimming down the high beam light of one's vehicle to low beam automatically as soon as the mounted camera detects a vehicles light from opposite direction.

II. PROBLEM STATEMENT

Headlight which assists the driver to have a better vision in the night time driving conditions becomes the reason for many accidents. Drivers of most vehicles make use of high, bright beam while driving at night resulting to an accident for the oncoming vehicle at times. Due to these irresponsible drivers, who do not concatenate between the switching of light, eventually causes a discomfort to the person travelling from the opposite direction and hence experiences a bright glare for a short period of time. This effect is known as Troxler Effect.

Troxler Effect is also known as the fading effect. Troxler Effect is a phenomenon in which a person reveals a blind spot due to some intensity light directly focused at his eyes. This is a form of glare due to which the retina of a human is filled with bright light and hence takes longer to respond. The reaction time of a person increases by 1.4-.19 seconds due to this illusion effect. Considering a person is travelling at a speed of 100kmph and due to Troxler Effect the person suffers blind spot for around 1.5 seconds. In just 1.5 seconds the vehicle can travel a distance of 41.6m which is more than enough for any mishap to take place. This effect takes place due to the rods and cones being over exposed to the light. Even once the light is being removed the effect lasts for some considerable time enough for any mishap to take place. The effect can take place over all the age groups and sex.

Many a times bigger vehicle drivers when crash with a smaller vehicle claim that they were not able to see the smaller vehicle due to the excessive brightness of the smaller vehicle. Due to this excessive glare the drivers are unable to see through properly which eventually results in such hazardous consequences. Hence this becomes a serious issue to be considered and headlight switcher system can be a very effective system to

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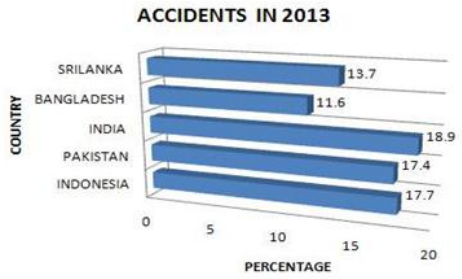
reduce this kind of accidents with a very affordable price for setup.

From the survey in graph 2.1 by Forbes, India has the highest number of accidents in the year 2013; the system can be a very effective approach toward reduction of accidents and provide more comfortable driving conditions to the drivers in any driving scenario. Accidents which occur in the world have been increasing every year but the safety to any driver is not up to the mark due to the price competition in today's automobile market.



Graph 2.1: Accidents in Asia in 2013

III. DESIGN AND IMPLEMENTATION

A.Hardware

Raspberry Pi is an open hardware which uses Broadcomm SoC(System on Chip) that runs many of the main components of the board like CPU, Graphics, memory, etc. it is a complete Linux computer that provide all the abilities in which implementation is done at low power consumption level. Figure 3.1 shows the basic functional diagram of Raspberry Pi.

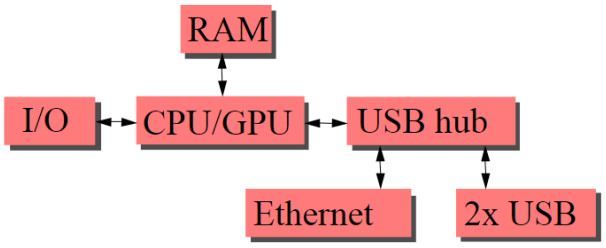


Fig 3.1: Functional diagram of Raspberry Pi

Camera is the second requirement for the implementation of the system. This camera is to be selected such that there is significant amount of resolution for the capturing of the video to be processed.

The block diagram is a simple assembly of commonly used components. The layout is shown in Figure 3.2. The components have been chosen with utmost care and accuracy so as to keep the design simple and easy to implement.

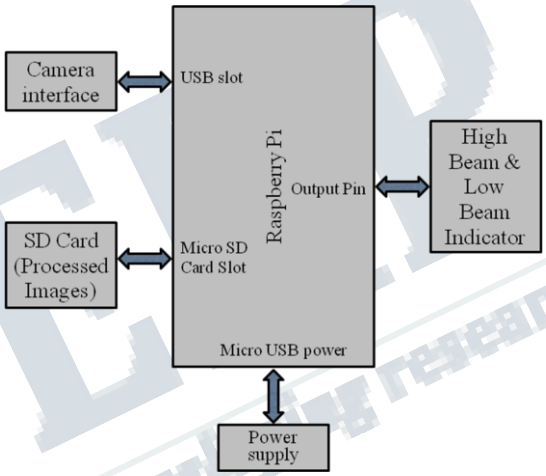


Fig 3.2: Block Diagram of hardware unit

B.Software

Software for the processing of the videos is to be implemented which can be a MATLAB(Matrix Laboratory). This is image processing tool box which provides overall set of reference standard algorithm and work flow acts for the processing and analysis of the frames. On integrating MATLAB code with other languages it enables in deploying algorithm and application within production system.

The Raspberry Pi is the main processing controller of the system wherein the camera is connected and mounted on the windshield of the vehicle so as to have the full view of the oncoming vehicles as shown in fig 3.3. The video being captured is sent to the processing unit through the Ethernet patch cord. This camera has a

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significant resolution which is best suited for the capturing and processing of the video. The full hardware view of this system is shown in fig 3.4. Fig 3.5 shows the system flow diagram.

Fig 3.3: Camera mounting in the vehicle

Fig 3.4: Hardware setup of the system

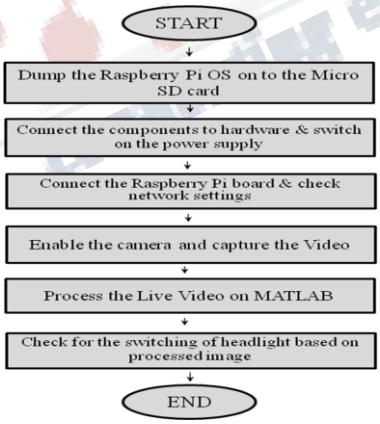

Fig 3.5: System flow diagram

IV.DISCUSSION

The automotive vehicles used in the present day world use different types of lamps to provide illumination under different operating conditions. They majorly use headlights on highways to control and generate the high and low beams accordingly. High beams provide intense distribution of light with no proper control of the oncoming glare up to 70m whereas low beams provide adequate distribution of the illumination up to 25m-50m without causing the troxler effect to the drivers in the opposite direction as shown in fig 4.1. To increase our visibility to other drivers and to avoid unwanted hazards it is important to switch the high beam or low beams on depending on the prevailing condition and the time of the day. With this technique low beams are used whenever a vehicle is detected and high beam is used whenever the road is empty with no vehicles.

Fig 4.1: Comparison between low and high beam

The light spot detecting algorithm mainly focuses on the thresholding algorithm. It is an image segmentation process which converts the gray scale image into a binary image by processing the input image. A threshold value for an image under discussion is being set. This threshold can vary accordingly and can be set according to the required standards. The purpose of

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setting this threshold as a constant is to make the pixels of an image which are lesser than this threshold into a null pixel. This is the basis of the thresholding algorithm for an image.

In the fig 4.2 the images at different stages can be seen clearly with the noticeable changes.

Fig 4.2(a): Input image

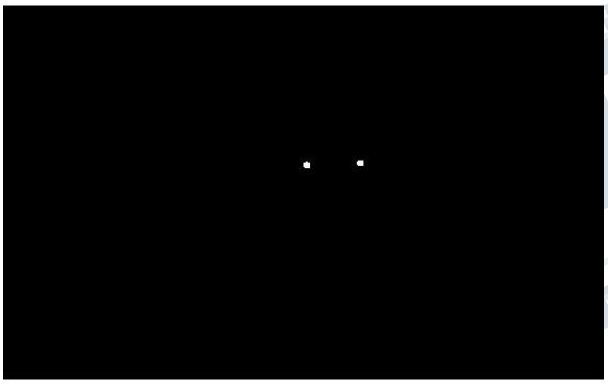

Fig 4.2(b): RGB to Grey

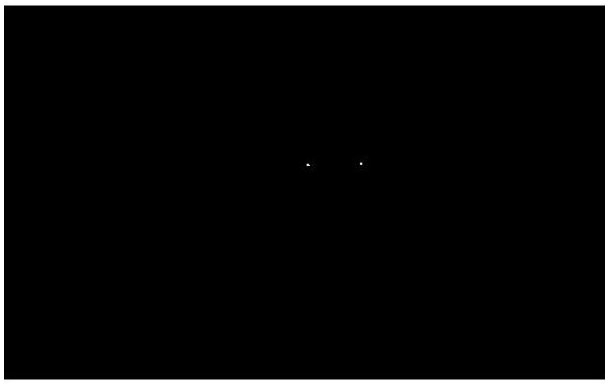

Fig 4.2(c): Removal of noise

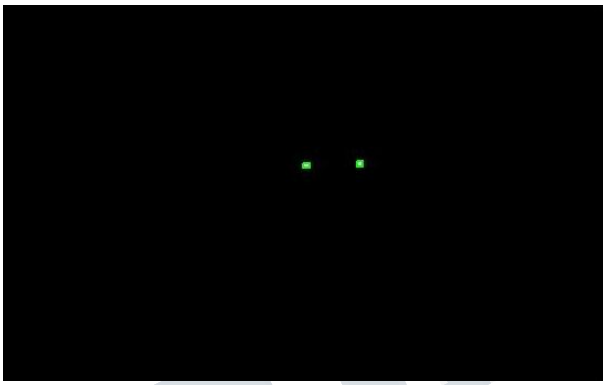

Fig 4.2(d): Bounding box

The above image (fig4.2 (a)) is the basic image that can be seen in the night time and processed images follows the original image. The figure below (Fig 4.3) shows the block diagram of the processing of each frame being captured

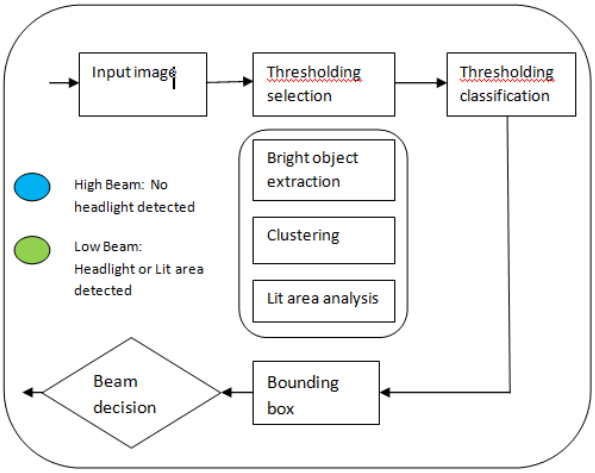

Fig 4.3: Block diagram of each frame captured

CONCLUSION

The bright light directly falling upon the driver's eyes pose to be a very serious problem for the driver as the driver's eyes are not compatible to adjust to the sudden exposure of bright light. This leads to a phenomenon called Troxler Effect which is nothing but temporary blindness. Ultimately most of the accidents

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are caused due to this phenomenon. The driver should be conscious enough to switch from high beam bright light to the low beam immediately so that it won't be a problem for the driver coming from the opposite side and therefore the glare can be avoided. Therefore, is the need for the design of a prototype system called headlight switching system. This system gives the driver to use the high beams when required. The automatic switching of the headlight from high beam to low beam is done when the system senses the vehicle approaching from the other side. The system components can be easily installed and are economical. This image processing system is even more economical as compared to the LDR usage. Thus the implementation of this system will not only reduce the accidents but also improve the safety measures and comfort for the driver.

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